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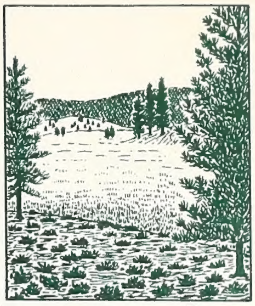

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PRUNING PONDEROSA AND JEFFREY PINE

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Ponderosa and Jeffrey pine shed their limbs very slowly. Consequently they must be pruned if clear lumber or veneer is desired in second-growth timber that is grown in rotations of 140 years or less. The pruning ought to be done at an early age to produce as much clear wood as possible. Furthermore, in open stands the lower limbs of these pines grow rapidly in diameter. If delayed, pruning may become too costly because of the large branches resulting from rapid growth.

Pruning also ought to extend as high as possible to increase the yield of clear wood. An important question, then, is: how much of the live crown can be removed without seriously reducing the tree's growth rate? Studies in other regions have indicated that removing one-fourth has little effect on growth rate, and pruning half the crown often does not have a serious effect. Experimental pruning in California has shown that half the live crown can safely be removed if four-tenths of the tree height remains in green crown after pruning.

The Study

The study was started at Blacks Mountain Experimental Forest in 1947. Twenty-five groups of four ponderosa or Jeffrey pine crop trees were selected in an open-grown stand. Treatments consisted of no pruning and removal of one-fourth, one-half, and three-fourths of the green crowns, assigned at random to the four crop trees in each group. The diameters of the trees were recorded when the study was started and 2 years and 5 years later. The 100 trees selected for the experiment ranged from 2.8 to 8.8 inches in diameter and averaged 5.4 inches. Study trees were selected at the rate of about 20 per acre in stands with densities of 40 to 50 per acre. The average site index at Blacks Mountain is 72. 1/

1/ Meyer, Walter H. Yield of even-aged stands of ponderosa pine. U. S. Dept. Agr. Tech. Bul. 630. 59 pp., illus. 1938.

The California Forest and Range Experiment Station is maintained at Berkeley in cooperation with the University of California.
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Results

For the first 5 years after pruning, removal of one-fourth of the crown had no effect on diameter growth (table 1). Removal of half the crown reduced the growth rates by about 23 percent. Thirteen trees, or 52 percent, of those with three-fourths of the crown removed died. All of the trees that died had been attacked by the red turpentine beetle (Dendroctonus valens Lec.). Five other trees with three-fourths of the crown removed, two with one-fourth of the crown removed, and one with no pruning survived attacks of this beetle.

Table 1.--Diameter growth after pruning ponderosa and Jeffrey pine, Blacks Mountain Experimental Forest

Amount of live crown removed	Annual growth: First 2 years	Annual growth: 3 to 5 years	Five years growth	Basis, trees
	- - - Inches	- - -	Inches	Number
None	0.36	0.30	1.63	25
1/4	0.35	0.32	1.68	25
1/2	0.22	0.27	1.27	25
[1] 3/4	0.06	0.12	0.49	12

[1] Only trees alive at the end of 5 years included.

Perhaps the most striking thing shown by this study is the rapid diameter growth rate of open-grown young trees. All of the trees with none or one-fourth of the crown removed grew 1.0 inch or more in 5 years; 90 percent of them grew 1.3 inches or more in 5 years. The maximum growth was 2.6 inches for 5 years. All of the trees with half of the crown removed grew 0.8 inch or more in 5 years, and 92 percent grew 1.0 inch or more.

Although growth was reduced by removing half of the crown, it still was adequate for practical purposes. For one thing, annual growth increased during the first 5 years. If this trend continues, the trees with half their crowns removed can be expected to be growing as fast as those with only one-fourth removed before the end of the second 5-year period. Then too, higher pruning could mean that an extra 4-foot length of bole can be pruned. Then the total amount of clear wood produced should be greater even though the growth rate is temporarily reduced.

Length of live crown averaged 0.86 of the total height of the trees. Eighty-four percent of the trees had crowns longer than 0.80 of the total height. On the average, trees with one-fourth of the crown removed had a remaining crown length of 0.64; those with half of the crown removed, 0.43; and those with three-fourths of the crown removed, 0.22 of the total height of the trees.

Thus it would be appropriate to remove as much as half of the green crown in pruning, provided that at least four-tenths of the total height of the tree retained live crown after pruning.

Supporting Evidence

In another thinning study half of the crop trees were pruned and half were not on plots in moderately to fully stocked pole stands. The average d.b.h. of the crop trees was 7.6 inches, and their average crown length was 0.62 of the total tree height. Not more than a third of the green crown was removed from any tree, the average being about one-fourth.

The average crown length after pruning was 0.53 of the total tree height. Growth was practically the same on pruned and unpruned trees, being only 0.03 inch less per pruned tree for a 5-year period. Consequently, by inference, removal of half of the green crown can be recommended for all ponderosa and Jeffrey pine if at least four-tenths of the total height remains in green crown after pruning.

Application

As a practical guide to pruning, curves were prepared for total height of crop trees by diameter to show the height to which trees of different d.b.h. could be pruned (table 2). A pruning height of 0.6 of total height was assumed. On the average, open-grown crop trees must be 8 inches in diameter before 10 feet of bole can be cleared and 14 inches in diameter before a height of 18.5 feet can be pruned. In contrast, closely grown 4-inch diameter trees can be pruned to 10 feet and 9-inch trees can be pruned to 18.5 feet. Consequently, in the typical eastside pine of northeastern California pruning must be done in two or more stages if the knotty central core is to be kept small.

Table 2.--Total height and maximum pruning height, by d.b.h. [1]

D.b.h., inches	Crop trees in open stands		Crop trees in closed stands	
	Total height	Pruning [2] height	Total height	Pruning [2] height
	Feet	Feet	Feet	Feet
4	12.0	7.2	16.5	9.9
6	15.5	9.3	22.5	13.5
8	19.5	12.7	28.5	17.1
10	23.0	13.8	34.5	20.7
12	27.0	16.2	40.5	24.3
14	31.0	18.6	46.5	27.9

[1] Site index 70. See footnote 1, p. 1.

[2] Pruning height when four-tenths of total height is left with green crown. Pruning to height greater than 18.5 feet is not recommended.

In general, trees should be pruned when they are as small as possible to permit the growth of the widest possible ring of clear wood. Sometimes, however, pruning of trees as large as 14 inches in diameter can be justified. For example, a fairly large knotty core is less objectionable in a veneer bolt than in a sawlog. Also, it is better to prune a vigorous, dominant 14-inch tree than a slower growing neighbor of smaller diameter. In establishing maximum size of trees to be pruned, expected growth rate, necessary minimum radius of clear wood and planned time of harvesting all must be considered.